Protocol Development Summary for NCCN

Title: Stream hydrology (short name: Hydrology)

Parks: Mount Rainier, Olympic, North Cascades

Justification:
Streamflow is a critical abiotic factor for aquatic and terrestrial ecosystems, and has significant impacts to NPS roads, campgrounds and other facilities. In the Pacific Northwest, sensitivity to climate change, frequent, large floods, and pronounced summer drought underscore its importance. Further, variability in terrain and microclimate in the North Coast and Cascades Network (NCCN) renders the small number of existing sites inadequate for monitoring streamflow.

Background:
Streamflow is recognized as the number 14 priority on the NCCN list of monitoring questions. Streamflow is currently monitored at a very small number of sites in the NCCN. Most of these locations are on the larger rivers that feed hydroelectric developments, leaving almost no sites on smaller streams that are more sensitive to flow variation.

Monitoring Objectives:
The general goal of this project is to monitor natural variability and trends in streamflow at a sufficient number of sites to characterize the range of climatic and hydrologic conditions.

(1) The primary objective is to monitor streamflow through time at multiple ecosystem scales to characterize the magnitude, frequency, and duration of extreme and average flow events.

(2) Use existing geospatial data to determine the minimum number of maintained, in-park stream measurement sites necessary.

(3) Provide a direct link to other monitoring projects by assessing the range of natural variation and temporal trends of stream flow in smaller streams and stream networks (most larger rivers have stream gages). Link with random streamflow measurements, glacier mass balance data and snowpack data.

Monitoring Questions from Vital Signs Workshops:
What are the range, natural variability and trends in streamflow at multiple spatial and temporal scales?

Are bank-full hydraulic variables stable for major streams in unit? (hydraulic geometry and stream habitat)?

How is stream channel process influenced by land use (e.g. vegetation management, roads and bridges)?

Monitoring Approach:
The monitoring approach for NCCN is focused on the three large parks, which have the vast majority of the streams in NCCN.

(1) Identify locations for new stream gages in the three large parks. Based on preliminary results from ongoing research, we anticipate the need for 6-12 new sites per park[1]. Locations for monitoring will be based on:

- Other aquatic monitoring (index sites) and park information needs.
- How well the sites represent the stream flow regimes within each park. This is based on the physical watershed parameters factors that locally control stream flow (e.g., site geology, aspect, glacier-sourced, elevation and climate).
- Logistical efficiency.
- Data needs to complete a methodology to estimate streams flows with a minimum of field measurements[2].

(2) Install and maintain in-stream pressure transducers and continuously monitor discharge though time in 6 to 12 streams per park.

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Development Schedule, Budget and Expected Interim Products:

(1) Schedule

- Summer 2004 = assist with completion of ongoing research; begin development of SOPs.
- Winter 2004-2005 = assess needs by park to develop sampling design
- Summer 2005 – Winter 2006 = write protocol and SOPs for NCCN
- Summer 2005 = install and calibrate 18-36 stream gages in NCCN

(2) High-end budget

- Equipment:
  -purchase 25 new pressure transducers and hardware $1,000/unit
  -11 units are extant; purchase 25 new units $25,000 total
- Personnel for installation and calibration (1st year)
  -3 Pay Periods/park for GS8/9 Physical Science Tech term - $6750/park

[1] The minimum number of required sites is presented as a range here, because ultimate site selection will be greatly influenced by the results of the on-going synthetic hydrograph project, currently in its last year of funding.
[2] This is an extension of the on-going synthetic hydrograph project, and supports the overall monitoring goal, stated earlier.

for an NCCN total of $20,250 1st year

- Personnel for annual operation and maintenance
  -2 Pay Period/park for GS8/9 Physical Science Tech term - $4500/park
  for an NCCN total of $9,000 annually

(3) Low-end budget

- Equipment
  -purchase 7 new pressure transducers and hardware $1,000/unit
  -11 units are extant; purchase 7 new units $7,000 total
- Personnel for installation and calibration (1st year)
  -2 Pay Periods/park for GS8/9 Physical Science Tech term - $4500/park
  for an NCCN total of $13,500 1st year
- Personnel for annual operation and maintenance
  -1 Pay Period/park for GS8/9 Physical Science Tech term -$2250/park
  for an NCCN total of $6,750 annually

(4) Interim Products

- Assist with implementation of 'Synthetic Hydrograph' research project
  -product = continuous streamflow measurement for about 12 sites
  -product = initial development of SOPs
- Assist with development of recommendations from above research
  -product = selection of index sites/sampling scheme
  -product = utility of hydrologic response maps
  -product = GIS model to support site selection